TITLE OF INVENTION

Inflatable Thermal Blank t with St rile Acc ss

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] Not Applicable

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not Applicable

BACKGROUND OF THE INVENTION

1. Field of Invention

[0003] This invention relates to a blanket for covering at least a portion of the body of a human, or other animal, in order to bath the body portion in a conditioned gas. More specifically, the present invention is related to an inflatable thermal blanket having air flow channels for directing a conditioned gas, such as, for example, heated air, to a selected portion of the body of a user while allowing a medical person to access a portion of the body with sterile access.

2. Description of the Related Art

[0004] Inflatable thermal blankets which are used to communicate a conditioned gas, such as heated or cooled air, to a patient are known in the art. Such thermal blankets typically have an inflatable portion provided with an inlet port for placing the inflatable portion in fluid communication with a source of pressurized, conditioned gas such that the inflatable portion can be selectively inflated. The inflatable portion generally has an inner surface which is gas pervious, or which is otherwise adapted to communicate the conditioned gas used to inflate the blanket to the user. Such thermal blankets are often used to treat conditions such as hypothermia, or used to reduce the body temperature of a user in circumstances where the body temperature is inappropriately high. For example, where a patient is being treated for hypothermia, at least a portion of the

patient's body is covered with the thermal blanket, and warm air is pumped into the inflatable portion. The warm air used to inflate the inflatable portion is thereafter communicated through the inner surface of the inflatable portion so as to bath the body portion covered by the blanket in warm air. Examples of such thermal blankets are disclosed in U.S. Patent Nos. 5,184,612; 5,304,213; and 5,324,320.

[0005] Whereas prior art thermal blankets serve to deliver conditioned air to a patient, the temperature of the air being communicated through the inner surface of the inflatable portion, and the surface temperature of the inner surface, can vary greatly over the area of the inner surface. For example, if heated air is pumped into the inflatable portion through the inlet port, the air within the blanket near the inlet port tends to be substantially higher in temperature than the air within the blanket which is remote from the inlet port. Accordingly, the inner surface of the blanket proximate the inlet port, and the air communicated to the patient through the inner surface of the blanket proximate the inlet port, can be uncomfortably, or damagingly, hot when the blanket is otherwise communicating air of the desired temperature to the patient. Whereas the temperature of the air entering the inlet port can be reduced to avoid uncomfortable, or damaging, hot spots near the inlet port, such a reduction of temperature can compromise the overall effectiveness of the thermal blanket.

[0006] United States Patent Number 5,443,488, titled "Thermal Blanket with Surgical Access," issued to Namenye, et al., on August 22, 1995, discloses "a disposable pneumatic thermal blanket for controlling a patient's body temperature wherein the blanket includes structure for providing access through the blanket for surgical purposes." The '488 patent discloses an access opening **74** through the blanket **10** formed by a plurality of perforated slits **26**, **28**, **30**, **34**, **38** extending through the blanket **10**. The perforations initially hold the shape of the blanket **10** during shipping and handling and weaken the blanket **10** so that the desired access opening **74** is formed by pulling the blanket **10** apart upon opposite sides of the slits **26**, **28**, **30**, **34**, **38**. The excess blanket material or flaps **68** are rolled to form rolls **72**, which expose a portion of the body under the blanket **10**.

[0007] United States Patent Number 5,674,269, titled "Patient Warming System with User-Configurable Access Panel," issued to Augustine on October 7, 1997, discloses a U-shaped pneumatic thermal device **100** for controlling a patient's body temperature and a deformally resilient, insulating access panel **118** between the tube legs **110**, **112** of the thermal device **100**. The access panel **118** has pliable, opposing fingers **200**, **201**, which are pulled away from the patient **104** to provide access. The panel **118** has pliable, opposing fingers **206**, **207**, which are tucked between the patient **104** and the device **100** to provide access. The fingers **200** to **207** are created by tearing perforations between the fingers to be separated from the panel **118**.

BRIEF SUMMARY OF THE INVENTION

[0008] According to one embodiment of the present invention, a full body pneumatic therapy blanket with sterile access is provided. The therapy blanket covers the body of a patient and has an access opening formed in the area of the blanket that covers the chest of the patient. Another embodiment of the therapy blanket has a perforated slit in the area between the access opening and the patient's neck. Still another embodiment provides a blanket that covers the lower half of the patient, with a taped connection securing the blanket to the patient.

[0009] The thermal blanket includes an inflatable portion for receiving the conditioned gas under pressure and for being positioned over at least a portion of the body of the user. The inflatable portion is defined by a base sheet which is fabricated of a gas pervious material, or which is otherwise adapted for communicating the conditioned gas to a portion of the body, and by an outer sheet which is substantially gas impervious. The inflatable portion also includes an inlet port for placing the inflatable portion in fluid communication with a source of conditioned gas. The inflatable portion is constructed so as to direct the conditioned gas along defined paths inside the inflatable portion. The defined paths are channels formed by joining the base sheet and outer sheet. Another embodiment provides an inflatable portion that also includes a barrier sheet that is positioned adjacent the base sheet and which prevents the conditioned gas from passing through that portion of the base sheet so protected.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0010] The above-mentioned features of the invention will become more clearly understood from the following detailed description of the invention read together with the drawings in which:

Figure 1 is a plan view of one embodiment of a therapy blanket;

Figure 2 is an exploded, perspective view of the therapy blanket; and

Figure 3 is a plan view of another embodiment of a therapy blanket.

DETAILED DESCRIPTION OF THE INVENTION

[0011] An inflatable thermal blanket in accordance with the present invention is illustrated generally at **10** in Figures 1 and 2 and generally at **10'** in Figure 3. The thermal blanket **10**, **10'** is designed to cover at least a portion of the body of a human, or other animal, and to bath at least a portion of such body with a conditioned gas, such as thermally conditioned air. The thermal blanket **10**, **10'** is particularly useful in bathing a body portion in air which has been heated to a temperature above normal body temperature in order to treat conditions such as hypothermia. However, it will be understood that gaseous fluids other than air can be used, and in certain applications the gaseous fluid utilized may be delivered to the body portion at a temperature which is at, or lower than, normal body temperature, as in the case where the existing body temperature is abnormally high and cooling is desired. The thermal blanket **10**, **10'** is suitable for sterilization and use in a sterile environment.

[0012] Figure 1 illustrates a thermal blanket **10** for covering the full body of a patient. The blanket **10** is rectangular and includes an inflatable portion **114** surrounded by a seam **112**, which joins the sheets **202**, **204** forming the blanket **10**. The blanket **10** extends beyond the inflatable portion **114** so as to drape over the patient in order to help retain the conditioned gas communicated to the patient. About where the patient's chest would be located under the blanket **10** is an access opening **104**. The access opening **104** is smaller than the area bounded by seam **116**, which forms one boundary of the inflatable portion **114**. The edges

of the access opening **104**, in one embodiment, are taped to the patient to provide sterile access to a portion of the patient's body. Taping the edges of the access opening **104** prevents the air escaping from the blanket **10** from entering the access opening **104**.

[0013] In the illustrated embodiment, the blanket **10** is designed to accommodate the neck of a patient in slot **102**. The inlet port **140**, located near the feet of the patient, is available for connecting a blower for inflating the blanket **10**.

[0014] The inflatable portion **114** is defined by the seam **112**, which contains the inflatable portion **114** near the outside edge of the blanket **10**, and by the seam **116** around the edge of the opening **104**. Inside the inflatable portion **114** are air flow channels **142**, **144**, **152**, **154** formed by other seams **132**, **134**, **136**. A pair of air flow channels **142**, **144** extending the length of the inflatable portion **114** are defined by seams **112**, **116**, **132**. This pair of air flow channels **142**, **144** has a series of alternating seals **124**, which serve to prevent the channels **142**, **144** from inflating to a large cylindrical shape. A group of parallel inside channels **152**, **154** are defined by seams **132**, **134**, **136**. These channels **152**, **154** serve to flatten the blanket **10** across the legs of the patient. Because of the barrier sheet **106**, the conditioned air does not exhaust through the inside channels **152**, **154**.

[0015] The seams **122** define two un-inflated regions in the inflatable portion **114**. The un-inflated regions serve to direct the air from the inlet port **140** into the various air flow channels **142**, **144**, **152**, **154** by dividing the inflatable portion **114** near the inlet port **140** into three channels. Those skilled in the art will recognize that, by varying the placement of the seams **122**, the amount of air flowing into the channels **142**, **144**, **152**, **154** can be controlled.

[0016] In one embodiment, seam **138** is a double wide seam with perforations aligned along the centerline of the seam **138**. By pulling the fabric of the blanket **10** away from the seam **138**, the perforations separate and a slit is formed in the blanket **10** where the seam **138** is located. This slit provides an opening for routing catheters, tubes, wires, and other items to the patient in the

area of the patient's neck and upper chest. Those skilled in the art will recognize that the width of each of the perforated seams can be varied to provide the necessary strength after the seam is perforated and that the seam can be a single-width seam without departing from the spirit and scope of the present invention.

[0017] In another embodiment, the seams **152**, **154** are double wide seams with perforations aligned along the centerline of the seams **152**, **154**. By pulling the fabric of the blanket **10** away from the seams **152**, **154**, the perforations separate and slits are formed in the blanket **10** where the seams **152**, **154** are located. These slits provide an opening for routing catheters, tubes, wires, and other items to the legs of the patient.

[0018] Figure 2 is an exploded view of the embodiment of the thermal blanket **10** illustrated in Figure 1. The base sheet **204** is a substantially rectangular sheet fabricated of a substantially air permeable material, such as, for example, a natural or synthetic non-woven material through which air under pressure can be communicated. Whereas synthetic materials such as, for example, polyester, can be used, the use of a cellulose or paper based material has advantages where a single use, disposable thermal blanket **10** is desired. In another embodiment, the base sheet **204** is fabricated of an air impermeable material that is provided with openings through which gas can pass. In still another embodiment, the base sheet **204** is fabricated of a material that is air permeable in selected areas and otherwise air impermeable. The top sheet **202** is a substantially rectangular sheet fabricated out of a substantially air impermeable material, such as, for example, a cellulose based sheet material coated with a film of polyethylene or polypropylene. Between the base sheet **204** and the top sheet **202** is a barrier sheet **106**, which is impervious to gas. The barrier sheet **106** is a substantially rectangular sheet fabricated out of an air impermeable material, such as, for example, polyethylene or polypropylene.

[0019] Reinforcing collar **212** for the inlet port **140** has an opening **214** for receiving the end of the supply hose from a blower. The collar **212** is secured to the top sheet **202** with an adhesive. The opening **214** is approximately 2-1/4 inches in diameter. In one embodiment, the top sheet **202** does not have a

corresponding opening in the top sheet **202**. When the thermal blanket **10** is used, the portion of the top sheet **202** within the opening **214** is torn to allow the insertion of the end of the hose. In another embodiment, the area to be torn is scored to aid in tearing.

[0020] The base sheet **204**, the top sheet **202**, and the barrier sheet **106** are heat bonded together within the inflated portion **114** of the blanket **10** at seams **122**, **124**, **132**, **134**, **136**, **138**. The base sheet **204** and the top sheet **202** are heat bonded together to form the inflated portion **114** of the blanket **10** at seam **112**. The seams **112**, **116**, **122**, **132**, **134**, **136**, **138** are formed, in one embodiment, by heat bonding. Those skilled in the art will recognize that various adhesive or other bonding methods can be used without departing from the spirit or scope of the present invention.

[0021] In the illustrated embodiment, the barrier sheet **106** extends from the foot of the blanket **10** to the opening **104**. In another embodiment, the barrier sheet **106** extends the full length of the blanket **10**, with the portion covering the opening **104** cut out.

[0022] In the illustrated embodiment, the opening **104** is shown as being formed in the base sheet **204** and the top sheet **202**. In another embodiment, the sheets **202**, **204** are joined before the opening **104** is formed in the blanket **10**.

[0023] In one embodiment, the blanket **10** is sterilized for use in a sterile environment. In one embodiment, the blanket **10** is sterilized by conventional sterilization techniques. The material of the blanket **10** sheets **202**, **204**, **106** is such that conventional sterilization techniques do not damage or degrade the material. Once sterilized, the blanket **10** is placed in a protected container or carrier, which prevents the blanket **10** from being contaminated.

[0024] Figure 3 illustrates another embodiment of a therapy blanket **10'** for covering a lower portion of a patient. In this embodiment, the inflatable portion **114'** is sized to cover the lower portion of the patient. Sections of tape **302**, **304**, **306** are attached to an edge of the blanket **10'** for attaching the blanket **10'** to the

patient. The sections of tape **302**, **304**, **306** prevent the exhausted air from blowing over the patient's chest or abdominal area.

[0025] The inflatable portion **114'** of the illustrated embodiment is bounded by seams **112**, **312**, **314**, **316**. The conditioned air is exhausted in a pair of air flow channels **142'**, **144'** located on the sides of the inflatable portion **114'**. Between the channels **142'**, **144'** are a group of parallel inside channels **152**, **154** defined by seams **132**, **134**, **136**. These channels **152**, **154** serve to flatten the blanket **10'** across the legs of the patient. Because of the barrier sheet **106**, the conditioned air does not exhaust through the inside channels **152**, **154**.

[0026] Seams **312**, **314** are double wide seams with perforations aligned along the centerline of the seams **312**, **314**. By pulling the fabric of the blanket **10'** away from the seams **312**, **314**, the perforations separate and the un-inflated portion **322** separates from the blanket **10'** at the seams **312**, **314**, thereby allowing access to an exposed portion of the patient either by folding the un-inflated portion **322** away from the patient or by securing the tape **304** to the patient and routing catheters, tubes, wires, and other items to the patient through the slits opened at the seams **312**, **314**.

[0027] Various portions of the inflatable thermal blanket perform various functions. The function of forming an inflatable portion is implemented by the top sheet **202** and the base sheet **204** joined at seams **112**, **116** to form an inflatable portion **114**, **114'** and seams **112**, **116**, **132**, **134**, **136** form a pair of outside channels **142**, **144** and at least one channel **152**, **154** formed between said pair of outside channels **142**, **144**.

[0028] The function of introducing the conditioned gas into the inflatable portion **114**, **114'** is performed by the inlet port **140**. The function of exhausting the conditioned gas from the inflatable portion **114**, **114'** is implemented by the base sheet **204** being formed of an air permeable material. In one embodiment, the base sheet **204** is formed of a material that is air permeable. In another embodiment, the base sheet **204** is formed of a material with orifices that pass the conditioned air. In one embodiment, the function of exhausting the conditioned gas is implemented by the inflatable portion **114**, **114'** which includes a pair of

outside channels **142**, **144**, **142'**, **144'**, which exhaust conditioned air through the air permeable base sheet **204**. In another embodiment, the function of exhausting the conditioned gas is implemented by the inflatable portion **114**, **114'** which includes a pair of outside channels **142**, **144**, **142'**, **144'**, which exhaust conditioned air through the air permeable base sheet **204**, and at least one inside channel **152**, **154**, and the inside channels **152**, **154** include a barrier sheet **106** which prevents conditioned air from being exhausted from the inside channels **152**, **154**.

[0029] The function of providing access through the inflatable portion **114**, **114'** is performed by the access opening **104**. The function of preventing the conditioned gas from being exhausted towards the access opening **104** in the inflatable portion **114**, **114'** is implemented by excess material between the edge of the access opening **104** and the seam **112** defining the opening **104**. This excess material is adapted for taping to the body or other covering of the patient.

[0030] The function of preventing the conditioned gas from being immediately exhausted toward a patient is implemented, in one embodiment, by the barrier sheet **106**. In another embodiment, the un-inflated regions defined by seams **122** redirect the conditioned gas and prevent the immediate exhaustion of the conditioned gas toward the patient.

[0031] The function of moderating a temperature of the conditioned gas in the inflatable portion **114**, **114'** is implemented by the channels **142**, **144**, **142'**, **144'**, **152**, **154** formed in the inflatable portion, in combination with the barrier sheet **106**. The temperature is moderated by preventing the air from being immediately exhausted toward the patient and routing the conditioned air through the various channels **142**, **144**, **152**, **154** to allow mixing with cooler air in the inflatable portion **114**, **114'** and to allow the conditioned air to cool slightly as it travels through the channels **142**, **144**, **152**, **154**.

[0032] The function of restricting the conditioned gas from being exhausted from the at least one inner channel **152**, **154** is implemented by the barrier sheet **106** being positioned in the area of the inner channels. The function of sterilizing

the blanket **10**, **10'** is implemented by sterilizing the fully assembled blanket **10**, **10'** and enclosing it in a container to prevent contamination.

[0033] The function of providing a second access through the blanket **10**, **10'** is implemented, in one embodiment, by the perforated seam **138**, which can be separated to form a slit. In another embodiment, the blanket **10**, **10'** has perforated seams **152**, **154**, which can be separated to form slits through which instruments and tubes can be routed to the patient. In other embodiments, the blanket **10'** has perforated seams **312**, **314**, which can be separated to form, in one embodiment, a flap **322**, which can be folded over, or, in another embodiment, slits through which instruments and tubes can be routed to the patient.

[0034] The function of securing the blanket **10'** to the patient is implemented by the tape sections **302**, **304**, **306** attached to the end of the blanket **10'** that is positioned proximal the patient's torso. The function of creating a slit is implemented, in various embodiments, by perforating a seam **138**, **152**, **154**, **312**, **314**.

[0035] From the foregoing description, it will be recognized by those skilled in the art that a pneumatic therapy blanket with sterile access has been provided. An inflatable therapy blanket has an opening in the patient's chest area. In another embodiment, perforated seams are positioned along the longitudinal axis of the blanket. By breaking the perforation, a slit is formed, allowing access to the patient's body from outside the blanket.

[0036] While the present invention has been illustrated by description of several embodiments and while the illustrative embodiments have been described in considerable detail, it is not the intention of the applicant to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art. The invention in its broader aspects is therefore not limited to the specific details, representative apparatus and methods, and illustrative examples shown and described. Accordingly, departures may be made from such details without departing from the spirit or scope of applicant's general inventive concept.